

U.S.S.N. 10,811,621

Please replace paragraph 0018 with the following re-written paragraph:

0018 In accordance with these and other objects and advantages, the present invention is generally directed to a composition and method which substantially enhances the wetting of an electrolyte solution to a seed layer on a substrate in the electrochemical plating of a metal such as copper on the seed layer. The composition is an organic mixture which includes an organic acid, such as citric acid or acetic acid, and a low molecular weight ionic polymer such as an alcohol, an amine or ~~alkyl~~alkylphenol alkoxylate. According to a typical method of the invention, a metal seed layer is initially deposited on the substrate. An electrochemical plating (ECP) electrolyte solution is prepared, and the organic composition mixture is dispensed as a layered suspension into the solution. The substrate, with the metal seed layer deposited thereon, is then moved through the suspended composition mixture layer and into the ECP electrolyte solution, such that some of the composition is layered into a wetting layer on the seed layer and enhances wetting of the electrolyte solution to the metal seed layer on the substrate. The substrate is then suspended in the solution and subjected to electrochemical plating. The electroplated metal forms a layer

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of high structural integrity substantially devoid of pits or other structural defects across the entire surface of the seed layer.

Please replace paragraph 0026 with the following re-written paragraph:

0026        The composition of the present invention includes a mixture of an organic acid, such as citric acid or acetic acid, and a non-ionic polymer such as an alcohol, an amine or an alkylphenol alkoxylate. Preferably, the non-ionic polymer is a low molecular weight (<1,000 MW) non-ionic polymer. The organic acid is present in the composition mixture in a quantity of from typically about 2 to about 20 wt. %. The non-ionic polymer is present in the composition mixture in a quantity of from typically about 0.5 to about 10 wt. %.

Please replace paragraph 0029 with the following re-written paragraph:

0029        In still another embodiment, the composition includes a mixture of an organic acid such as citric acid or acetic acid and alkylphenol alkoxylate. Preferably, the composition includes

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typically about 10 wt. % of the organic acid and typically about 5 wt. % of the ~~alky~~alkylphenol alkoxylate.

Please replace paragraph 0033 with the following re-written paragraph:

0033 Referring to FIGS. 1, 1A and 2, according to the method of the present invention, a metal seed layer 19, such as copper, is deposited on a wafer substrate 18, as indicated in step ~~[[S]]~~51 of FIG. 2. The metal seed layer 19 may be deposited on the substrate 18 using conventional chemical vapor deposition (CVD) or physical vapor deposition (PVD) techniques, according to the knowledge of those skilled in the art. The seed layer 19 has a thickness of typically about 50-1500 angstroms.

Please replace paragraph 0034 with the following re-written paragraph:

0034 As indicated in step S2 of FIG. 2, the electrochemical plating (ECP) electrolyte bath solution 20 is prepared in the bath container 14. Next, as indicated in step ~~[[S]]~~53, the organic composition mixture of the present invention is prepared and then suspended as a composition suspension layer 26 in the

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bath solution 20. The anode 16 and substrate 18 are then immersed in the bath solution 20 and connected to the adjustable current source 12 typically through wiring 38.

Please replace paragraph 0035 with the following re-written paragraph:

0035 As shown in FIG. 1A and indicated in step [[S]]54 of FIG. 2, the cathode/substrate 18 is immersed in the bath solution 20 by passing the substrate 18 through the composition suspension layer 26. As shown in FIG. 1A, the seed layer 19 on the substrate 18 contacts the composition suspension layer 26 and causes a wetting layer 26a to break off of the composition suspension layer 26 and adhere to the surface of the seed layer 19. This wetting layer 26a remains on the seed layer 19 during the subsequent electroplating process. It will be appreciated by those skilled in the art that the wetting layer 26a promotes wetting of the ECP electrolyte bath solution 20 to the seed layer 19 during the electroplating process.

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Please replace paragraph 0036 with the following re-written paragraph:

0036        As indicated in step [[S]]55, a metal layer (not shown) is electroplated onto the seed layer 19 as follows. In operation of the ECP system 10, the current source 12 applies a selected voltage potential, typically at room temperature, between the anode 16 and the cathode/substrate 18. This voltage potential creates a magnetic field around the anode 16 and the cathode/substrate 18, which magnetic field affects the distribution of the copper ions in the bath solution 20. In a typical copper electroplating application, a voltage potential of about 2 volts may be applied for about 2 minutes, and a current of about 4.5 amps flows between the anode 16 and the cathode/substrate 18. Consequently, copper is oxidized typically at the oxidizing surface 22 of the anode 16 as electrons from the copper anode 16 reduce the ionic copper in the copper sulfate solution bath 20 to form a copper electroplate (not illustrated) at the interface between the cathode/substrate 18 and the copper sulfate bath 20. By promoting uniform wetting of the electrolyte bath solution 20 to the entire surface of the seed layer 19, the wetting layer 26a facilitates electroplating of the metal onto the seed layer 19 as a continuous metal layer substantially devoid of structural deformities such as pits. Accordingly, the

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electroplated metal layer on the substrate 18 contributes to the fabrication of IC devices that are characterized by high structural and operational integrity.